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HEALTH TECHNICAL MEMORANDUM

HEALTH BUILDING ENGINEERING INSTALLATIONS: COMMISSIONING AND ASSOCIATED ACTIVITIES

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Health Building Engineering Installations: Commissioning and Associated Activities

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Health Technical Memorandum
Health Building Engineering Installations: Commissioning and Associated Activities

Introduction

This Technical Memorandum replaces the one produced in 1967. The revision has been carried out by representatives of the Department of Health and Social Security, Regional Health Authorities, the Building Services Research Unit, Consulting Engineers and Contractors. The object is to assist Health Authorities and, where appropriate, Local Authorities in the organisation of commissioning of engineering installations in health buildings. It has been revised to take into account the experience of Health Authorities and others who have been concerned with the commissioning of engineering installations in buildings and developments in commissioning practice since 1967.

In the 1967 edition of the Hospital Technical Memorandum, commissioning of engineering installations was considered as being made up of a number of activities related to design, construction and performance of the completed installation. In this Memorandum it has been re-defined so as to agree more closely with definitions used in other published material dealing with the subject. As re-defined, engineering commissioning refers to the process of advancing an engineering installation from the stage of static completion to full working order to specified requirements. Other matters which were formerly considered as being part of engineering commissioning, and which are closely related to it, have been classed as associated activities and are dealt with under that heading.

Engineering installations may be provided under contracts governed by a variety of conditions but most contracts should be placed using standard forms. For health building projects, one of the Standard Forms of Building Contract (SFBC) issued by the Joint Contracts Tribunal will most frequently be used and this Memorandum is written so as to be consistent with the rights and obligations of the parties named in a contract governed by SFBC. Parts of it may be inappropriate where contracts are placed using other forms of contract.

The Commissioning Manuals published as supplements to the 1967 issue of HTM17 are no longer in an appropriate form and will be withdrawn. Procedural and technical supplements to this Technical Memorandum are in course of preparation, guidance on procedure will conform with the principles described and the practices recommended in this Memorandum. The technical supplements will take into account changes which have taken place since the issue of the manuals in 1967.

1 Scope

1.1 The Memorandum describes points which should be observed by those carrying out the design, construction, commissioning and testing of health building engineering installations; reference is made in it to the obligations of designers, contractors and others involved in the provision of satisfactory engineering installations in health buildings.

1.2 Although the Memorandum has been prepared to meet the needs of Health Authorities who are concerned with the commissioning of large engineering installations, it may be applied, with the necessary changes, to minor works and to the commissioning of special items of engineering plant or equipment.

2 Definitions

2.1 The following definitions apply throughout:

i. *Commissioning*: the advancement of an engineering installation from the stage of static completion to full working order to specified requirements.

ii. *Associated Activities*: design and other activities which especially influence or are influenced by the commissioning procedure.

iii. *Testing*: a process which goes beyond visual inspection and which seeks to determine whether equipment and installations meet the specified requirements. It includes as appropriate:

a. On-site or off-site tests, during the construction stage, which are concerned with safety and soundness of equipment or installations e.g. pressure, leakage and cross-connection tests. These are done in advance of the commissioning procedure.

b. Off-site tests of plant or equipment related to acceptability and compliance with specified requirements.

c. On-site tests of the equipment and installations in whole, or in part, for acceptability and compliance with specified requirements.

iv. *Health Authority/Local Authority*: a body, frequently referred to as the Client or Employer, for whom the design is prepared and the works carried out, and who pays for the work.

v. *Designer*: the person, appointed by the Health Authority, who is responsible for the design of the engineering installations and the design documentation.

vi. *Contractor*: the person or persons, firm or company, under contract to carry out the works set out in the contract documents. In this Memorandum the term Contractor and contract has been used for convenience but where the SFBC is used the terms include sub-contractors and sub-contracts.

vii. *Supervising Officer*: the person named in the contract and who exercises general direction and supervision of the contract in accordance with the provision which it contains. The SFBC refers to this person as the Architect/Supervising Officer.

viii. *Site Engineer*: any person appointed by the Health Authority to assist the Supervising Officer in watching and recording progress, and inspecting the works.

ix. *Commissioning Engineer*: the person appointed by the Contractor to execute the commissioning process in accordance with the contract.

x. *Client's Commissioning Adviser*: the person appointed by the Health Authority to advise whether the installation meets the requirements specified by the Health Authority.

3 Commissioning

3.1 Where, as is usually the case for health buildings, engineering installations are to be handed over in full working order, the Contractor should execute the commissioning and perform any demonstration which is necessary before installations can be accepted for use.

3.2 Commissioning procedures should be sufficiently thorough and systematic so as to identify, together with normal site inspection, any obvious installation deficiencies and design errors or omissions. The Contractor is responsible for the rectification of defective work but any pro-

blems which result from the design of the installation should be referred to the Supervising Officer for his decision.

3.3 As an immediate preliminary to the setting-to-work of an installation the Commissioning Engineer is expected to carry out a full check and inspection to confirm that the installation and its components are in a safe and satisfactory condition. He should verify that all statutory notices are displayed and that arrangements have been made so that installations may be safely commissioned. The commissioning process is not however, a substitute for the normal inspection and supervision which is necessary during construction to ensure that the material and equipment used are of the type and quality specified and that the workmanship is of the required standard.

3.4 When the preliminary checking and inspection of an installation have shown that it is in a safe and satisfactory condition, or after any deficiencies which have been revealed during this process have been put right, the Commissioning Engineer should proceed to set it to work and adjust and regulate it as necessary, in accordance with the contract requirements.

3.5 Commissioning will include where appropriate: the energising of electrical installations; the setting of machinery into motion; verifying the operation of controls, safety devices and alarms; the regulating of flow quantities and the setting of controls within limits specified in the contract documents, eg, the setting of room thermostats to 20° ± 2°C.

3.6 Where commissioning involves adjustment and setting of manual or automatic control devices to regulate the flow of air or fluid to various parts of a distribution system, the procedure used by the Commissioning Engineer should be that specified in the contract documents.

3.7 The Contractor should prepare and submit records of measurement and of settings related to the installation both as offered for acceptance and as finally commissioned.

3.8 In some cases it is impossible to prove by on-site tests that plant and equipment will perform in accordance with the manufacturer's or supplier's performance guarantees. In these cases, or where it is appropriate to do so, performance testing of major items of plant or equipment should be done away from the site eg, at the manufacturer's works or where suitable test rigs can be provided. This will enable the comissioning procedure to be followed in the knowledge that these items of plant have been shown to be capable of performing to specified requirements. On-site testing of such things as rates of flow and the general adjustment of installations can then be made on the basis of known plant characteristics and output.

3.9 Where the Contractor is required to demonstrate that an installation has been commissioned in accordance with the specified requirements, this should be done before Practical Completion. Any such demonstration should be only for the purposes of showing that the Contractor has fulfilled the contract requirements. (See also paragraphs 4.22 to 4.27 inclusive and paragraph 5.5.)

3.10 The Client's Commissioning Adviser, Health Authority and Hospital Engineers, the Designer and others who may be concerned with the maintenance and use of installations, should be permitted, in accordance with arrangements provided in the contract, to witness the commissioning procedure, testing and working demonstrations.

3.11 The programme for the works should include adequate time for commissioning which should be properly integrated into the overall programme of the site activities.

3.12 The Site Engineer should ensure that he is kept informed of the progress and programme of commissioning so that he can make adequate arrangements for performing those functions which have to be carried out on behalf of the Supervising Officer. The Supervising Officer should ensure that the installation has been commissioned in accordance with the specified commissioning procedure and should verify this by such checks as he considers necessary.

3.13 Close attention should be given to the commissioning of each installation as the work proceeds so that further additional checks, designed to show that the Contractor has fulfilled the contract requirements, are kept to those which are necessary. The Client's Commissioning Adviser should consult the Supervising Officer and together they should ensure that adequate arrangements are made and that sufficient staff are provided to supervise the commissioning work as it proceeds.

4 Associated Activities

(a) **Design and Tender Preparation**

4.1 Part of the technical information provided in the tender or contract documents should relate to the commissioning of the installation.

4.2 Drawings, specifications and other technical information should be comprehensive and in sufficient detail to enable tenderers to assess the effect on their costs and site programme of engineering commissioning, and to price for it in their tender.

4.3 The Designer should include in the contract documents descriptive matter necessary to assist the Commissioning Engineer in understanding the commissioning needs and in planning his work. This information may include such things as flow and line diagrams and descriptions of the working of the installation.

4.4 The Designer should arrange in the design of the installation for proper facilities to enable safe commissioning and associated activities to be carried out. Among matters which should be considered are the provision and location of test points at which measurements can be taken during the commissioning stage. Where necessary complex systems should be divided into a number of sections to assist in adjusting equipment and balancing flow quantities during the commissioning process.

4.5 The Designer should specify the commissioning procedure either by reference to established codes of commissioning, amended by him as necessary, or by setting down in detail the procedure to be followed by the Contractor.

4.6 The Designer should prepare and include in the contract documents any special instructions relating to testing during construction. These may refer to on-site or off-site tests. Designers should specifically refer to tests which are concerned with safety and soundness of equipment or installations, and which should be undertaken before commissioning starts. Further safety tests which are to be done during the commissioning process should be included in the commissioning instructions in the contract documents.

4.7 Many commissioning codes do not include for demonstration of the proper working of an installation after being set-to-work. Certain installations eg, sterilizers, need to be demonstrated before being accepted for use. In such cases detailed information should be included in the tender and contract documents so that tenderers can price their work. (See paragraph 4.5.)

4.8 Where testing is carried out, whether on-site or off-site, the Designer should make provision in the design documentation for verification of the accuracy of instruments, also for a procedure for approving the calibration of test instruments and the method of measurement or both.

4.9 There are limits, however, to the extent to which it is practicable to arrange commissioning procedures which will be sufficiently extensive and related to realistic working conditions at the time of hand-over eg, because of seasonal influences or because the building is unoccupied. In such cases the Designer should frame the acceptance procedures to show that the Contractor has met his contractural obligations and provide the details of performance and other tests which are to be carried out later by others. (See paragraph 4.25.)

4.10 Adequate arrangements should be made for the co-ordination of the commissioning and demonstration procedures, either by selecting certain Contractors and including for these duties in their contracts or by special provision in the Main Contract. This should be done as part of the general co-ordination requirements under the contract. For installations involving the work of different specialist contractors and suppliers, it is important that tender and contract documents should be prepared in sufficient detail for the tenderers to be fully informed of the extent of their obligation for carrying out commissioning and demonstrations with other contractors.

4.11 The extent and form of contract record documentation including that relating to commissioning, acceptance and performance testing should be specified by the Designer and detailed in the contract documents.

4.12 During the design stage the Client's Commissioning Adviser may, without diminishing the responsibility of the Designer or relieving him of any of his duties, bring his specialised knowledge of commissioning to assist the Designer in resolving any difficulties in the interpretation of the Health Authority's instructions, and relating them to the commissioning and testing of installations.

4.13 The Client's Commissioning Adviser will also require sufficient information concerning the design to allow him to assess whether the design, as prepared, will be satisfactory from the point of view of commissioning an installation. He will examine the commissioning and acceptance procedures proposed by the Designer so that he can

advise the Health Authority that proper provision has been made in the contract for commissioning and demonstrating an installation which can be safely operated and maintained by the Health Authority.

(b) **Construction Stage**

4.14 The construction stage covers the period from the handing over of the site to Practical Completion. During this stage of the project the installation in whole, or in part, should be commissioned and, where appropriate, demonstrated by the Contractor before acceptance.

4.15 Proper commissioning of an installation requires that the works have been correctly carried out and are complete. Checks which are undertaken as a preliminary to commissioning should be done in a systematic and progressive fashion and proper records should be kept by the Commissioning Engineer. Where the contract requires it, the records should be produced either to the Site Engineer or to the Supervising Officer as evidence that the installation is in a safe and satisfactory condition to be set to work, and is regulated and adjusted as necessary.

4.16 Checks made as a preliminary to commissioning should not be a substitute for those which should be made during the earlier stages of the work in accordance with well established engineering practice.

4.17 The responsibility for ensuring that the installation meets the contract requirements is the Contractor's. The Supervising Officer and Site Engineer have the duty however of watching the progress of the work and inspecting it as it proceeds. In exercising these functions they should be guided, as necessary, by the Designer. Where the installation is complex or novel the Designer should prepare advice to assist the Site Engineer in discharging his supervisory functions on behalf of the Health Authority. Any guidance of this kind should be separate from the contract and it should cover on-site and off-site testing as well as the commissioning and acceptance procedures. Where appropriate, guidance on testing methods should be provided.

4.18 Site tests for such matters as the soundness of piped installations, crossed connections, leaks and electrical insulation or continuity tests, should be undertaken as the construction work proceeds. Details of the requirements, the stage of construction at which they should be carried out and other particulars should be included in the contract specification. For many installations these are essential as preliminaries to the setting-to-work procedure.

4.19 The testing and recording of results of on-site tests during the course of construction should be the responsibility of the Contractor; either the Supervising Officer or the Site Engineer should witness the tests, confirm the recorded results as genuine and determine whether all the specified requirements have been satisfied.

4.20 Where the contract so provides, major items of plant and equipment may be tested off-site (see paragraph 3.8). Where off-site tests will not be repeated during commissioning, the Supervising Officer should arrange to witness the tests himself or for them to be witnessed on his behalf.

4.21 Records of on-site and off-site tests may be required to supplement any commissioning and acceptance test records, which are to be supplied to the Supervising Officer before Practical Completion, in accordance with the specified requirements. Details of the records which are to be supplied should be included in the contract specification.

(c) **Post-Handover Tests and Adjustments**

4.22 When the contract has reached the stage of Practical Completion, the engineering installations should have been commissioned and any demonstration which is necessary before an installation may be accepted for use should have been carried out. The installations should then be taken over by the Health Authority for maintainance and use.

4.23 The Health Authority and the Designer will often wish to know whether an installation which has been handed over meets the performance requirements of the Health Authority or whether changes are needed. In some cases the installation will have been demonstrated as part of the acceptance procedure prior to Practical Completion; this may be sufficient to satisfy the Health Authority and Designer that the installation meets the requirements.

4.24 Practical Completion should not be delayed because of the need for performance tests to be carried out, particularly where they may have to be deferred until conditions are right. In such cases the acceptance procedures should show that the contractural requirements have been met and the Designer should provide the Health Authority with details of the performance and other tests which are to be carried out after Practical Completion.

4.25 Provision may be made in the contract, where it is considered convenient, for the Contractor to carry out specified performance tests, before or after hand over, to record measurements and other information relating to

performance and to supply this to the Supervising Officer.

4.26 After installations have been completed and possibly been in use under full working conditions, adjustments to the controls and to the installations as a whole may be required so that they can perform effectively over the full range of working conditions. This work should be undertaken by the Health Authority's own staff or under a separate contract entered into for this specific purpose.

4.27 In preparing information relating to post hand-over tests and adjustments, whether at the contract preparation stage or later, the Designer should seek the advice of the Client's Commissioning Adviser, so as to make sure that the Client accepts the proposals which are being put forward. The Client's Commissioning Adviser should be sufficiently informed of the basis of decisions taken in respect of these post hand-over activities to be able to advise the Health Authority and Hospital Engineers on the interpretation of results. He should also be able to advise whether further tests should be done and whether changes are needed to installations.

(d) **Evaluation of Design in Use**

4.28 Health Authorities and the Client's Commissioning Adviser should review the performance of equipment and installations with the object of evaluating the effectiveness of the design in use.

4.29 Arrangements should be made to keep a record of the performance of plant, equipment and installations, noting especially successful features as well as any short-comings and user complaints.

4.30 These records should be reviewed by the Health Authority's engineer and, where appropriate, by the Clients' Commissioning Adviser in order that he may advise the Health Authority whether the installation meets the specified requirements.

4.31 It may be found during the first twelve months of use of the installation that, although the Contractor has done his work properly, the required results have not been reached. In such cases the Health Authority may decide, after reference to the Designer, that remedial work should be done. This may be carried out under a new contract, preferably after the defect liability period has expired, or by using the Health Authority's own staff. In either case care should be taken not to prejudice the Contractor's liability for defective work or materials.

4.32 The Client's Commissioning Adviser should review the design-in-use information and consider whether the Health Authority's general commissioning and acceptance practices and instructions to Designers need to be amended.

5 Documentation

5.1 Consideration should be given by the Client's Commissioning Adviser and the Designer to the preparation of documentation which will promote the systematic commissioning of installations and the production of adequate records.

5.2 The form in which checks, tests and inspections, carried out by the Contractor and witnessed by the Site Engineer during the construction stage are to be recorded, should be discussed between the Designer and the Client's Commissioning Adviser. Written records of the progress of the commissioning work, including measurements and details of settings, should be provided by the Contractor in accordance with provisions made in the contract. These will then provide a detailed record of the performance, after adjustment, of many parts of a system.

5.3 The Designer should discuss the preparation of guidance and information on the safe operation and maintenance of engineering installations with the Client's Commissioning Adviser, and proper provision made for the supply, under the contract or otherwise, of the technical information required by hospital engineers and others responsible for maintaining and using the installations.

5.4 Where possible information relating to maintenance and operation should be available well before Practical Completion. Details of settings and measurements should be prepared and made available at the conclusion of the commissioning stage. Drawings of the "as fitted" installation should be supplied at the earliest practicable date; development of fully co-ordinated engineering services drawings and other information as part of the pre-tender and post-contract procedure should facilitate the early hand-over of "as fitted" records.

5.5 Where further tests or adjustments of installations are required and these are deferred until after Practical Completion, the Client's Commissioning Adviser should ensure that information is prepared in sufficient detail to enable these to be done under separate contract arrangements or by the Health Authority's own staff.

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